MUSIC WITHOUT THE OCTAVE (and numbers)

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For Jérémie, my son and musician

In this essay, I will strengthen the position (almost) generally held that a reflexive[1] progenitive form of music enunciation would have existed long before any form of music theory was conceived (although some believe that humankind, ubiquitously and intemporally came along with a diatonic system engraved within the unconscious). For sure, the concept of theory did not happen out of nowhere. Slowly and organically the elusive idea osmosed through generative layers of non-octaval, non-linguistic, non-numeric, oligotonic, hemiolic and other hyper-systems, eventually reaching a 'tangible meaning' through the filtering of cognitive processes until the invention of writing, around 3,500 BC in the Middle-East. This invention formalised these processes at a time and at a place where pitches were sung independently from one another, as horizontal monodic incantations, one syllable for one pitch, excluding verticality, as a voice cannot sing two pitches simultaneously[2]. It would take time, probably with the development of collective chanting and later, with musical instruments, to envisage a form a embryonic heterophony, yet very far from any polyphony and even further from what I call the artificiality of harmony. Indeed if the ear is able to perceive a vast number of the simultaneous sounds of heterophony, polyphony and consonantal harmony, the vocal folds of the larynx can only produce one pitch at a time, or monody (monotony) asserting the artificiality of heterophony, polyphony and consonantal harmony which requires the association of several individuals to agree on spontaneous or synergistic schemes. Thus, musicians would have needed to formulate the idea of associative singing, or of the adding of instruments to their singing to provide with the fundamentals of heterophony before reaching the arcanes of heterophony, polyphony and harmony.

1 By 'reflexive' I mean that the earliest linguistic/musical intonations would have come from responses to stimuli which would have been replicated by the members of a group in the same way other idiosyncrasies propagated from one individual and then spread throughout a group and became a singular trait specific to that group, and eventually a recognisable tongue and a specific music for that group.

2 In principle, since there are two vocal folds, two simultaneous pitches are possible but normally, the folds are stretched to the same tension to produce the same pitch as they respond to a neural synchronisation for both folds, but in some abnormal cases a growth or obstruction of one of the folds may cause it to vibrate at a different pitch than the other thus producing two different pitches simultaneously, of course the subject cannot have any control over an affected fold.

We find earliest occurrences of prototypic music theory[3] with Sumerian, bilingual Sumerian-Akkadian and Akkadian texts from at least 2600 BC[4], and later with the Ancient Greek tradition[5], and further refined by theoreticians such as Neo-Platonician Boethius and others up to the first part of the twenty-first century. There is evidence of a Babylonian method resting on chains of consecutive conjoined thirds which flowed into the archaic enunciations of the Early Levantine Christian church and then propagated into the Christian West where it became Beneventan chant in Southern Italy, Roman in the city of Rome, Milanese in Northern Italy, Hispanic on both sides of the Pyrenees, Gallican in Roman Gaul where it eventually became Frankish-Roman.

After much decadence, these intonations were finally re-discovered mainly with the works of Dom Jean Claire, Dom Eugène Cardine and Dom Daniel Saulnier, both of the Solesme Abbey in France.

Essentially, the difference between the archaic enunciative intonation and Western systemic pentatonism/heptatonism is that the first is modal, in the original meaning of the word, and the second is tonal, or ruled by numbers.

The word 'modal[6]' has been badly wounded in the course of centuries of its misuse and as a consequence, its etymology is evasive, but I would define it as a musical enunciation which is not the consequence of any arithmetic construction, although some analyse it with sophisticated binary electronic musicologic tools. However, these graphic analysers can only record music as a 'snapshot' and are not statistical values averaging practice in a wider range of time and space.

Isodorus Hispalensis, otherwise known as Isodore of Seville, a Visigothic Scholar (560-636) wrote that *Nisi enim ab homine memoria teneantur soni, pereunt, quia scribi non possunt*, in his *De Musica*, or, (If [modal] sounds are not memorised by man, they are lost as it is not possible to write them down.) More recently, Henri Potiron (1882-1972) wrote that: *Au fond, il n'y a pas, il ne peut avoir, de théorie modale, ni de théoriciens. La modalité est un fait*. (After all, there is neither, nor can there be any modal theory, nor theoreticians. Modality is a fact[7].) Thus, the wisdom of both Isidore of Seville and Henri Potiron makes it clear that the specificities of modal enunciations are beyond the possibility of their transcriptions in any of the known systems from their inception to our days.

Therefore, our current understanding of the so-called Gregorian modes is that if they are sung in the equal temperament, or even worse, accompanied by the organ, (in Faurean modality) they cannot be called modal, but tonal, albeit with a fashionable modal accent.

3 Here, prototype theory is to be taken as a theory of categorisation in cognitive science.
4 Dumbrill, R., *The Musicology and Organology of the Ancient Near East*, Trafford, USA, (1998-2005), pp. 27-174.
5 The corpus of Ancient Greek music theory is enormous. However, I remain extremely cautious for the reason that there are no original manuscripts of ancient Greek musical theory dating from their inception and by their inceptors. All we know about it is from much more recent copies written about five hundred to a well-over a thousand years later.
6 Modal (adj.), pertaining to or affected by a mode, 1560s, originally a term in logic, from French modal and directly from Medieval Latin *modalis* of or pertaining to a mode, from Latin *modus*, measure, extent, quantity; proper measure, rhythm, song; a way, manner, fashion, style, (in Late Latin also mood in grammar and logic), from PIE root *med- to take appropriate measures. Musical sense from 1590s and in grammar from 1798.
7 Potiron, H., «*Théoriciens de la modalité*», Études grégoriennes 8 (1967), p. 36.

ab ovo...

The German musicologist Curt Sachs[8] (1881-1959) saw the development of horizontal intonations by means of enlargement of one-step patterns with occasional affixes from which processes led to the increasing of more and more of the musical space[9].

Sachs mentions initial consecutive secondal one-step and secondal two-step patterns which seems a reasonable proposition. By secondal is meant an interval of any kind of second and a secondal two-step intonation would involve two rising of falling undefined seconds, or of a rising followed by a falling and concluding with a rising, or the contrary. Any combination of these would have been used with different lengths, different rhythms, different accentuations, all of these sitting on each of the syllables of a monodic enunciation with articulations following and enhancing the quality and the ritualistic, totemistic, animistic, descriptive, etc., meaning of the incantation.

About classical transition from secondal one-step to secondal two-step patterns, Sachs' evidence rests on 'two oldest successive styles in which priests of India used to chant the sacred texts of the Vedas[10].'. This chant would have known three pitches, according to Pānini[11]. There is an *anudātta,* an *udātta* and a *svarita*. The *udātta* translates as 'raised', the *anudātta* means 'not raised' and the *svarita* means falling[12]. In his the Wellsprings of Music, Sachs illustrates these notations with the following example:

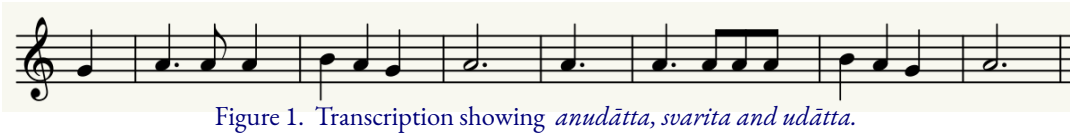

Figure 1. Transcription showing *anudātta, svarita and udātta.*

The example above shows a fundamental cell (or secundal two-step pattern) composed of three pitches separated by unqualified intervals of the second. There, the focal pitch is B. It is the nucleus of the cell which is contained within the interval of an unqualified third or it could be considered as the conjoining pitch of a group of two secundal steps, or a two-step secundal pattern.

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8 Sachs, Curt., *The Wellsprings of music,* Edited by Jaap Kunst, Martinus Nijhoff, The Hague (1962), p. 143.

9 Rowbotham, John, Frederick, *History of Music*, (London 1885) Seems to have been the first to see this phenomenon, according to Sachs.

10 Sachs, Curt, op.cit., p.143.

11 Pāṇini (Devanagari: पाणिनि, pronounced [paːɳɪnɪ]) was a Sanskrit philologist, grammarian, and revered scholar in ancient India, variously dated between the 6th and the 4th century BC. Since the discovery and publication of his work by European scholars in the nineteenth century, Pāṇini has been considered the 'first descriptive linguist', and was even labelled as 'the father of linguistics'. Pāṇini's grammar was influential on such foundational linguists as Ferdinand de Saussure and Leonard Bloomfield. https://en.wikipedia.org/wiki/P%C4%81%E1%B9%87ini

12 *Anudātta* literally means 'not raised'. The Vedic *Samhitās* have been preserved for millennia due to the well-organised system of '*svaras*' or intonations. Such svaras are of three types: *Udātta* - The *udātta* is without any sign. *Anudātta* - The *anudātta* is indicated by a horizontal line below the letter. The *svarita* is a vertical line above the letter.They are generally translated as 'raised,' 'not raised' and 'falling.' They are musical in nature. For instance: *Oṃ saha nāvavatu*. Here '*sa*' is an *anudātta* and '*na*' is a *svarita*. The other letters are all *udātta*. While chanting, the *udātta* letters are chanted as the basic note ('*sa*' or *ṣactja* of music), the *anudātta* as one note below ('*ni*' or *niṣāda*) and the *svarita* as one note above ('*ri*' or *ṛṣabha*). See *The Concise Encyclopedia of Hinduism*, Swami Harshananda, Ram Krishna Math, Bangalore. See also Felber, E., *Die indische Musik der vedischen und der klassischen Zeit, in Abhandlungen der K. K. Akademie der Wissenschaften,* Wien, 1912, no. 7. - Efw FE 4431 (p. 431) l. 3.

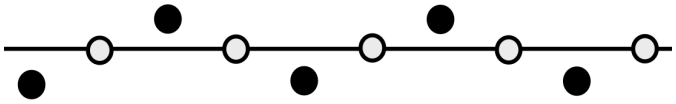

Figure 2. Schematisation of the melody in figure 1.

The next example of a secundal two step monody comes from the Arabian Peninsula. It is a sea song that Simon Jargy recorded and titled *chant de la mer*. It follows the same rules as in figure 2:

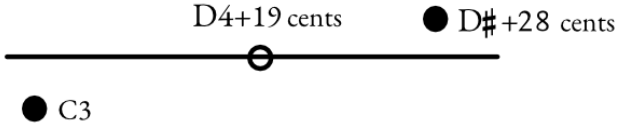

Figure 3. Extracted from a Melodyne analysis for the aforementioned sea song.

Example 3 was extracted from: *A musical anthology of the Arabian peninsula* Vol. 4 Collection Simon Jargy, women's Songs. Recording: 1968-1990 VDE CD 783 - track 1. Chant de mer. Musée D'ethnographie Genève, VDE CD 783.
https://www.musimediane.com/numero3/ALabussiere/index.html

The next example, number 4 is from Far-North Russia and is sung by a Chukchi. Recordings by: Cécile Guenoun. Playa Sound collection. Asia. PS 65189. SF / 501 - Track 31. Vassia Kevkei, song. Productions Sunset France-96, rue du Château, 92100 Boulogne-France. https://www.musimediane.com/numero3/ALabussiere/index.html

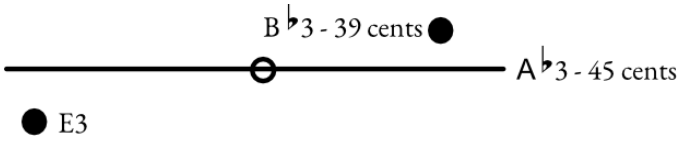

Figure 4. Extracted from a Melodyne analysis of an extract of the *Chukchi* song.

While example 1 and 3 are typical secondal two-steps monodies, example 4 consists of a rising empty tertian interval of a neutral third (= around 350 cents) then falling and then rising again to a neutral third + 200 cents = around 550 cents or the ratio of 500:303 also known as Meshāqah's 11 quartertones 11 x 50 = 550).

The next example comes from the Central African Republic: Anthologie de la Musique des Pygmées *Aka*. Recordings by Simha Arom. Ocora Radio France. Collection dirigée par Pierre Toureille. CD HM83 x 2 C559012 - 1er compact Disc, Piste 15 : 'nze-nze-nze'. Distribution Harmonia Mundi.
https://www.musimediane.com/numero3/ALabussiere/index.html

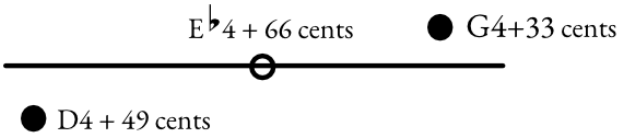

Figure 5. Extracted from a Melodyne analysis of an extract from a Central African Aka Pygmy song.

With example 5 above, the monody is systemically descending from a focal pitch G4 + 33 cents. It then falls to D4 + 49 cents , then it rises to E♭4 - 66 cents .

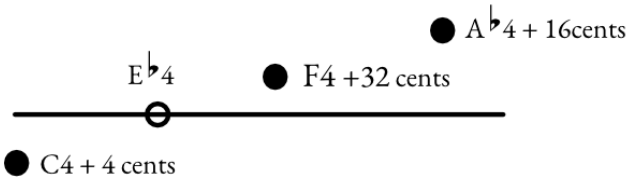

Figure 6. Extracted from a Melodyne analysis of an extract from a Navajo song from New Mexico.

Example 6 is the extract of a Navajo Song from New Mexico. Recorded by Laura Boulton in 1933 and 1940. 1992. Smithsonian/Folkways Recordings, CD SF 40403. Track 1. *Yebichei Song*. *Center for Folk-life programs and Cultural Studies* 995 L'Enfant Plaza Suite 2600, Smithsonian Institution, Washington DC 20560.
https://www.musimediane.com/numero3/ALabussiere/index.html

Example 1 and 2 are two-step secundal monodies which are the simplest form of intonation. The intervals between the three pitches fluctuate around the 'Western tone' and would vary with the nature of the words. Examples 3-7 also have irregular intervals which I have measured as an indication to show how they stand away, in their own right, from the Western equal temperament of tones of 200 cents and semitones of 100 cents. Even if this form of comparison may seem Occicentrist, my usage of it is strictly descriptive in the absence of anything better apart from the ear, but I cannot expect of all musicologists that they should be gifted with the ability of reproducing these monodies accurately for the purpose of teaching musicologic analysis. Thus, these figures are not intended to specify some precise intentional interpretation. They would have depended on mood, emotion, and the message hidden within words would only have been unconscious reflexive pitch variations. Generalists would classify these monodies as pentatonic anhemitonic, (examples 1 and 2) and, or trihemitonic (examples 3-7). I would prefer not to be so taxonomic and hear them as archaic modal intonations where we note that the voice has a propensity, in ethnic monodic intonation, to avoid, spontaneously the production of semitones but favours alternations of bi- and trihemitonic jumps at some point of the monody depending on the meaning of the text but not as a formal systemic rule.

Children's intonations

Sachs wrote[12] that 'Because in the current of culture and time [...] alternation patterns grew often from one step to two steps, from two to three steps, and so forth, the conclusion would seem logical that litany-like melodies on one note (or nearly so) must be older even than two-note melodies. But counting is a poor help in cultural history, the more so as repetition and alternation seem to differ beyond comparison, one exhibiting the need for either rest or for tension, and the other, for leisurely motion. The only statement that we dare propose is: one-note, as well as two-note formations belong in the earliest age of man. Those who believe in a parallel evolution of the human individual and the human kind will be satisfied to find both the one-note and the two-note formations among the very first babble songs of small children. The psychologist Heinz Werner recorded such songs a few decades ago[13].'. and 'It is exciting experience to learn that the earliest known stage of music reappears in the babble songs of small children in European countries. For once the ontogenetic law is confirmed: the individual summarizes the evolution of mankind.

These children could not be suspected to have been influenced by a single trait of our own music. Thus we cannot but accept their babbling as an ontogenetic reiteration of man's earliest music and, inversely, conclude that the music of today's most primitive peoples is indeed the first music that ever existed[14].'.

Sachs's perception of ontogenetics seems to be a bit hasty as if it is about the development of behavioural features from the earliest stages to maturity, it is difficult to agree that a fœtus in its uterine and amniotic environment would not be conditioned by a multitude of sounds for the duration of some nine months, well enough to develop a cognitive appreciation of what it has heard. Therefore I feel that the replication of pitches and intervals at a very young age would be reasonably inaccurate because of the infant's lack of synchronisation between what it heard and retained, and its ability to replicate accurately, not what it heard but what it thought it had heard. Children do not always voice what they hear and do not always hear what they voice because this depends mainly on the ability to retain the tonal elements of an early 'good musical education'. The same goes for languages, no matter how well you might pronounce the French 'bu' to an English child, (and even an adult) its replication will mostly result in a 'boo' while having reassured itself that it is a 'bu' that they voiced, and of course the same goes for the replication of consecutive intervals. A young child might not be able to repeat the consecutive pitches of a neutral third, but when it spontaneously sings a monody, the neutral third might come naturally. But the question remains: was it the child's intention to sing that precise third accurately?

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12 Sachs, Curt, *The Wellsprings of Music, op.cit.*, p. 72.

13 Werner, Heinz, *Die melodische Erfindung im Frühen Kindesalter, in K.K. Akademie der Wissenschaften zu Wien, Phil. -Hist. Klasse, Sitzungsber.*, vol. 182 (1907), no. 4. - See also Bruno Nettl, *Infant musical development and primitive music, in Southwestern Journal of Anthropology*, vol. 12 (1956), pp. 87-9I.

14 Sachs, Curt, *The Rise of Music in the Ancient World* (New York, 1943) pp. 43-44.

Then we would be understandably excused to draw a similarity between children's development of musical abilities to the phylogenetic development of music with certain other groups among which supporters of football matches with which I was burdened for many years, and still am, as I live not far away from the football club in the otherwise secluded borough of Chelsea, in London. The mass-incantations vociferated by thousands of inebriated fans are mostly of a spontaneous synchronistic and phylogenetic type of monodic anhemitonic oligotonic form, I will not say pentatonic since these monodies rarely reach the fifth. Thankfully, the distance from the stadium spares me the words. Thus, in addition to the vast recorded repertoire of many ethnic groups, there exists a phylogenetic phenomenon of which the evidence is proven through the congregation of supporters of sports such as football or rugby to mention only the two most common.

The simplest enunciations of music may belong to ethnic groups, children or football fans but in each case they have purpose and even with a small amount of primary pitches they may have a great variety of modal inflections generated by variations of interval sizes, stress, rhythmic aspects, diverse aspects of timbre, quality and meaning of the supported or supporting text, etc.

However, the repertoire of ethnic music is found with larger spans. I have chosen an example from the Arthur Morris Jone collection played on a *Mpiemo* xylophone recorded in the Cameroon on the 01/05/1970. It is available from the British library Sound Archives:

(https://sounds.bl.uk/World-and-traditional-music/Arthur-Morris-Jones/025M-C0424X0030XX-0100V0). The xylophone spans 11 pitches on 1,521 cents. It is therefore a descending hendecatonic hypermodal system. Some will object my decision to associate the span of the instrument to the span of a system but one may never assume that pitches beyond the octave are strayed and should be brought back into the fold where they belong. In the present case, there are eleven pitches with intervals between them never under 100 cents and never above 300 cents. There is, however, a notable pattern of alternation between short and long intervals. From the treble to the bass, the pattern is: short; long; short; long; short; long; short; long, short and short. The succession of two short intervals in the bass is indicative of the practice in other cultures to accumulate shorter intervals at the bass of a system but the reason might be, in this case, that the tuning of the wood blades is more difficult to achieve in the bass.

Transposed in our Western system, this would give: F5+$^{(21\text{cents})}$;E♭5+$^{(35\ \text{cents})}$; C5+$^{(74\ \text{cents});}$ B♭+$^{(8\ \text{cents})}$; G4+$^{(83\ \text{cents})}$; F4+$^{(51\ \text{cents})}$; D4 +$^{(63\ \text{cents})}$; C4 +$^{(30\ \text{cents})}$; A3 +$^{(52\ \text{cents})}$; G3 - $^{(1\ \text{cents})}$; F3 - $^{(1\ \text{cent})}$. This example introduces the alternation of shorter and larger intervals on an hypermodal system.

The next example also comes from the same source where the instrument, a lamellophone also has a descending hypermodal hendecachordal span of eleven pitches from F5 +$^{(8\ \text{cents})}$ falling to B3 + $^{(9\ \text{cents})}$. The sequence is as follows: F5 + $^{(8\ \text{cents})}$; E♭5 - $^{(9\text{cents})}$; D♭5 + $^{(34\ \text{cents})}$; B♭4 + $^{(13\ \text{cents})}$; A♭4 + $^{(0\ \text{cents})}$; F4 - $^{(21\ \text{cents})}$; E♭4 - $^{(51\ \text{cents})}$; D♭4 - $^{(51\ \text{cents})}$; B♭3 + $^{(3\ \text{cents})}$; A♭3 - $^{(12\ \text{cents})}$; D3 + $^{(9\ \text{cents})}$.

This system has the same characteristics of the previous hypermode as it shows similar alternations of short and long intervals.

Chains of thirds

Sachs[15] made a comparative link between the structure of monodies and tonal theory and was concerned with structural chains of thirds in many monodies from various world traditions, some of which I have illustrated with examples above, and says that in their majority, these monodies have only one triple structural chain, mainly [D-F-A-C/(*DeFg**A**-**C*)] but also [C-E-G-B/(*Cd**E**-**G**aB*)] or [F-A-C-E/(*Fg**A**-**C**dE*)], while a minority of these melodies rely on a quadruple structural chain [D-F-A-C-E/(*DeFg**A**-**C**dE*)] or even [C-E-G-B-D/*Cd**E**-**G**aBcD*], the sequences in italics showing the presence of a trihemitone (in bold) to avoid the semitone. Far from questioning Sachs' competence, I would nevertheless question his formal perception between major and minor thirds in the examples he gives. My own observations show, in the three cases, ethnic, children, and populist masses (football chanting), that thirds are never clearly adhering to our Western notion of 'major'; 'neutral'; and 'minor'. These intervals are sung in whatever size fits the mood of singers and in synchronisation with the tuning of instruments, such as chordophones and aerophones, (by the technique of partially blocking finger-holes). With lamellophones such as xylophones (balafons) or 'thumb pianos' (kalimbas/mbiras), sound duration is so short that their approximation is sufficient to match voice intonations when both are in approximate fusion. From my own experience and especially from past accounts of illustrious ethnomusicologists, the interval of the (just) fifth would be a preference with the three aforementioned groups. It would seem logical that if our folds have a predilection for the just singing of the consecutive pitches of a just fifth, rather than of any other intervals, (apart from the octave) that in reciprocation the ear would also prefer the hearing of these consecutive pitches. I would add that the hearing of the simultaneous pitches of a (just) fifth are not perceived in the same manner as the same consecutive pitches for the reason that both pitches, if produced simultaneously, are part of the harmonic series of the fundamental are therefore blend within the whole harmonic series of a same fundamental while when the same pitches are played consecutively, then, each of the two pitches sound as the fundamental of their own harmonic series, a fifth apart. The greater the time interval between the emission of both pitches, the greater their dissociation with the fundamental of the first and lowest emitted pitch. This phenomenon is even more observable with equal temperament minor, (≈63/50), [just intonation 6/5] neutral (≈153/125) and major thirds (≈44/37), [just intonation 5/4], which become less distinguishable when consecutive.

15 Sachs, Curt, *The Rise of Music in the Ancient World,* Norton, (New York - 1943)

Dom Jean Claire's archaic intonation

Musicorum et cantorum magna est distancia,
isti dicunt, illi sciunt quae componit musica;
nam qui facit, quod non sapit, diffinitur bestia[16]

In his *A few words about the study of paleography*[17], Léon Gautier wrote: 'The progress imposed on the study of sources with historical and archaeological sciences is clear. Thus, there is no longer any erudite who does not respect the law that the École des chartes established, from its earliest lectures to paleography students: "Sources, always sources, and never rely on secondary sources."'. This is also the narrative in one of my lectures, some years ago, at King's College, London when I warned students that they should never trust footnotes and meticulously investigate them until reaching the earliest possible source.

In his *Gregorian Chant*[18], Dom Daniel Saulnier writes about the pentatonic scale and its origins and mentions Guido of Arezzo as the theoretician having preserved the 'three possible ways of notating it' as follows

*g - a - * - C - D - E - * - g - a*

*c - d - * F - G - A - * - c - d*

*d - e - * - G - A - B - * - d - e*

According to Dom Saulnier, in Dr. Mary Berry's translation, the three degrees in the middle of these scales are what Dom Jean Claire called 'mother-notes'. They are the sources for archaic psalmody. 'The asterisk between the outer notes of the minor third represent the *pien*[19]. This is a weak non-structural note of negligible importance, often missing, but which can also make its appearance in a melody. It is mobile - that is to say, it can move either higher or lower within the minor third according to the center of gravity of the melody.' Many pieces of Gregorian Chant have kept these characteristics, notably the *In splendóribus* below:

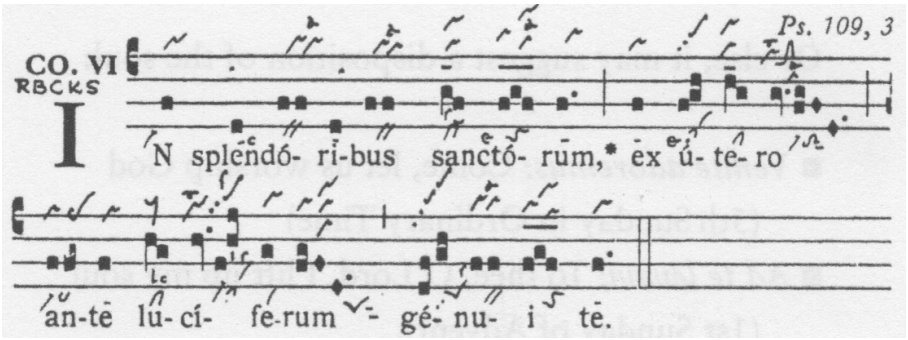


Figure 7. Psalm 110 (*Vulgate* 109) in the Old Testament: *In splendoribus sanctorum, ex utero, ante luciferum, genui te* which may translate as 'in the brightness of the saints: from the womb before the day star I begot you.' (Douay Bible, 1610).

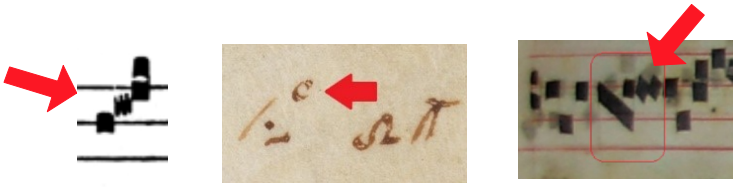
16 *Musicae regulae Guidonis;* see Gerbert, *Scriptores,* t.II, p. 25. '*Musicians and singers are at a great distance, they say that they know what makes music: for he who does what he does not know, is defined as a beast.*' Author's translation.
17 Gautier, Léon, *Quelques mots sur l'étude de la paléographie;* 2e éd., Paris, Palme, 1859; p. 15.
18 Saulnier, Dom Daniel, *Gregorian Chant, A guide to the History and Liturgy*. Paraclete Press, Brewster, MA, USA (2017, fourth printing in English), p. 53.

The degrees used in this psalm are:

Minor third, major tone, major tone, minor third of the second archaic intonation.
The degrees used in this hymn are:

Minor third, major tone, major tone, minor third, major tone of the second archaic intonation[20].

Dom Saulnier further writes, again in Mary Berry's translation, that 'It is quite remarkable to see that the earliest musical neumatic notations had from the very first, special signs to indicate certain details of this scale: the *quilisma* (see below) was used for the weak degree (*piena*), and the *stropha/strophicus*, (see below) for the strong, the one above the semitone. In the form of notation, that finally prevailed, only a single mobile *pien* remained, the B, which can be either natural or flat, two possible positions - in principle mutually exclusive.'



a b c

Figure 8. Hymn *Immense cæli conditor* (*hiemalis*). From the *Antophonale Monasticum.* Solesmes, 1934, p. 136.

The next example comes from the Hymn *Immense cæli conditor*

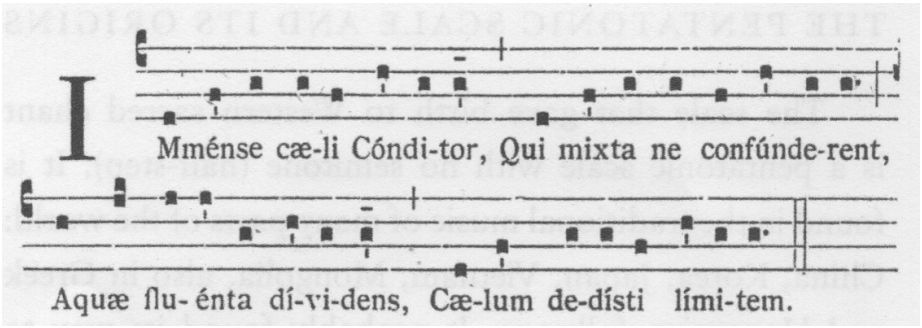


Figure 9. a) *quilisma* between *punctum* and *podatus*; b) strophicus as neume; c) *strophicus* and *quilisma* in square notation are composed of lozenges or jagged lines.

19 Saulnier, Dom Daniel, fn. 53, p. 139, In Mary Berry's words: The word *pien* comes the Chinese language: it is used for the two notes that transform the traditional Chinese pentatonic scale into a scale of seven notes. See Josef Yasser, *A Theory of Evolving Tonality* (New York: American Library of Musicology, 1932), p. 34.

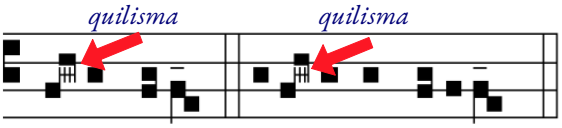


Figure 10. V/ *Sursum corda* R/ *Habemus ad Dominum.*

It is evident that the function of the trihemitone, re-discovered by Dom Jean Claire, remains of great importance in Gregorian composition. With the *Sursum corda* all four trihemitones written with *quilismata* are located on accentuated syllables: *Sú*$(3^{1/2})$*r sum corda*. *Habé*$(3^{1/2})$*mus ad Dominum*. *Gratias agá*$(3^{1/2})$*mus Domino Deo nostro*. *Dí*$(3^{1/2})$*gnum et iustus est*.

Non-octaval Hypermodes[21]

There has been a special scheme of tonal organisation which has been ignored mainly for the reason that it did not suit the traditional diatonic octaval followers who, for the most have rejected anything beyond the octave. Non-octaval hypermodes originate from the Ancient Near east as we shall see later and was adopted by the Ancient Greek as *systema metabolon* meaning 'the modulating system', also called the Lesser Perfect System. It then flowed into Byzantine chant and in Western Europe as the *Daseian* scale. This scale was wrongly understood as a series of four repeating tetrachords as:

Figure 11. tetrachordal non-octaval hypermode.

20 The sources for *In splendoribus sanctorum* are: Bamberg, Staatsbibliothek lit. 6 f. 5v Bavaricon p. 15; Benevento, Biblioteca Capitolare 33 f. 2v; Benevento, Biblioteca Capitolare 34 f. 15; Bruxelles, bibliothèque royale 10127-44 - Mont-Blandin AMS 9b; Chartres, Bibliothèque municipale 47 - Graduel f. 6r; Cambrai, Bibliothèque municipale 0075 (0076) - St-Vaast d'Arras f. 33v; Cologny (Genève), Bibliotheca Bodmeriana C 74 - St. Cecilia in Trast. f. 9r; Einsiedeln, Stiftbibliothek 121 f. 26; Graz, Universitätsbibliothek 807 f. 12v; Laon, Bibliothèque municipale 239 f. 24 Facsimilé p. 19; Montpellier, Bibliothèque de l'Ecole de Médecine H 159 f. 40v autre numérotation : 70; Noyon, Château du Mont-Renaud - Mont-Renaud f. 4; Paris, Bibliothèque nationale de France 776 - Albi f. 12; Paris, Bibliothèque nationale de France lat. 903 - Saint-Yrieix f. 15; Paris, Bibliothèque nationale de France lat. 12050 - Ant. Corbie AMS 9b; Paris, Bibliothèque nationale de France lat. 17436 - Compiègne AMS 9b; Paris, Bibliothèque nationale de France lat 18010 - Gr. Corbie f. 4r; Paris, Bibliothèque Sainte-Geneviève 111 - Senlis AMS 9b; Roma, Biblioteca Angelica 123 - Angelica 123 f. 28; Sankt-Gallen, Stiftsbibliothek 339 f. 42 Facsimilé p. 10; Sankt-Gallen, Stiftsbibliothek 376 p. 97; Zürich, Zentralbibliothek Rh. 30 - Gr. Rheinau AMS 9b.
For *Immense cæli conditor* (*hiemalis*), the author was probably Pope Gregory the Great (540-604). Meter: Iambic dimeter. This work is thus narrated by Moses: *Dixit quoque Deus: Fiat firmamentum in medio aquarum, et dividat aquas ab aquis. Et fecit Deus firmamentum, divisitque aquas quæ erant sub firmamento ab his, quæ erant super firmamentum. Et factum est ita. Vocavitque Deus firmamentum Cœlum: et factum est vespere et mane dies secundus* (Gen. 1, 6-8).

21 Nikolsky, Aleksey., *Evolution of Tonal Organization in Music Optimizes Neural Mechanisms in Symbolic Encoding of Perceptual Reality*. Part-2: Ancient to Seventeenth Century. Frontiers in Psychology, 2016. (https://doi.org/10.3389/fpsyg.2016.00211) It is however regrettable that the description of Ancient Near Eastern musicology has been described through the subjective and mostly biased views of one of the reviewers of this article. This has resulted in some incorrect facts about the music of the Ancient Near-East.

However, I would understand this sequence as a series of conjoined pentachords as:

Figure 12, pentachordal non-octaval hypermode.

This arrangement became the Georgian pentachordal hypermode as shown below with its pentachordal Dorian hypermode:

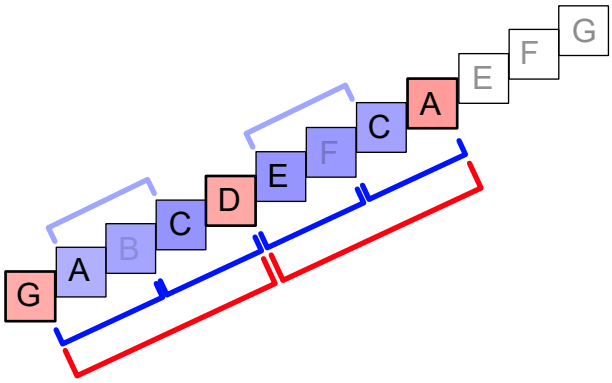


Figure 13. Pentachordal Dorian hypermode.

To the contrary of tetrachords, pentachords set a hierarchy of stable degrees. Note the conjoining of fifths and the chains of thirds.

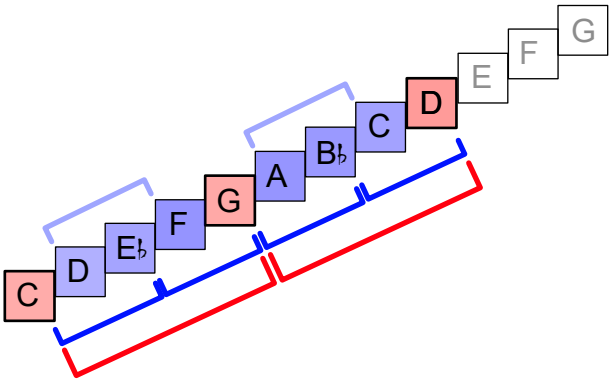


Figure 14, transposed to a fifth above C

I have shaded the third degrees of each fifth to keep this hypermode within its earlier hypermodal anhemitonic form, similar to Dom Jean Claire's archaic enunciation and the generative Babylonian non-octaval hypermodal enneachord that we shall investigate later.

Interlude

In these previous pages we have covered, succinctly and far too briefly, some aspects of emmelic oligotonality, hemiolicity and other non-octaval hyper-systemic and hyper-modal musicology. A book would be needed to address sufficiently each of the systems mentioned. These systems produced innumerable and remarkable melodies composed for the many circumstances in the lives of numerous ethnic groups, societies, civilisations, religions and other beliefs. None of these needed the octave, heptatonism or numbers for their inception and most have survived, probably from the time of the earliest human groups whence they came, to this day. But the most surprising is that while Christianity became essential for the propagation for the rule of the octave and other octoechos(es), through its scholars, notably Neo-Platonician Boethius, it was unknowingly celebrating, in its formidable incantational repertoire, the survival of a Middle-Eastern tradition which had been known since the earliest cuneiform texts and the iconography of the late third millennium BC and which was only reanimated with the enlightened works of Dom Jean Claire in the first part of the twentieth century at the Monastery of Solesmes in France.

The next section will show the process by which most Western musicologists used the elusive octave and heptatonism in all Ancient Near-Eastern musicology, as a kind of a crusade against all knowledge culturally united under various Semitic languages and peoples. They should have changed their views in the face of the proven evidence, but unashamedly, it is the evidence that they changed in order to suit their views. Whether this was intentional is debatable, but if it were not, then it would be their competence which would be left to our appreciation...

Evidence: CBS 10996

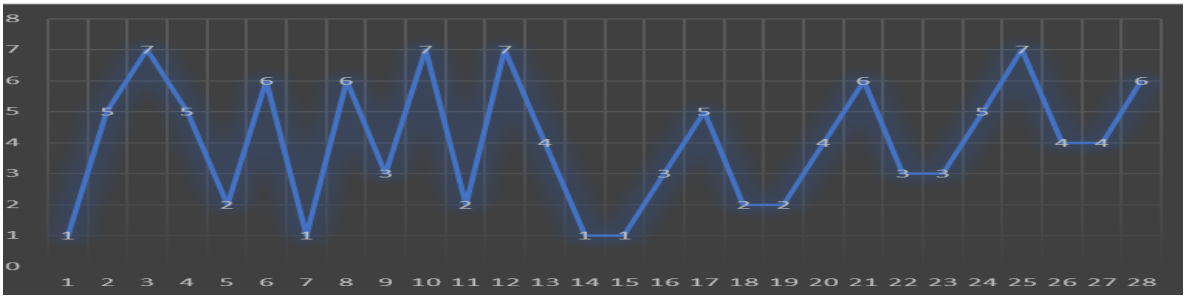
Neo-Babylonian text CBS 10996 (Catalogue of Babylonian Section number 10996) is very well-known among Assyriologists and musicologists having some interest in Middle-Eastern musicology. It was the first tablet including some aspects of musicology which was examined in 1960, by the young non-musicologist Assyriologist Anne Draffkorn Kilmer[22]. The tablet dates from the middle of the first millennium BC. I will not reproduce the text in this paper as it has been published *ad nauseam* and is freely available on the web. I will simply list the twinned numbers and the terms with which they are associated. Their meaning is yet to be clearly understood. The twinned numbers in the tablet are given in the present order and the names with which they are labelled:

1-5 (*niš tuḫri*); 7-5 (*šeru*); 2-6 (*išartu*); 1-6 (*šalšatu*); 3-7 (*embūbu*); 2-7 (*rebūtu*); 4-1 (*nīd qabli*);1-3 (*isqu*; 5-2 (*qablītu*); 2-4 (*titur qablītu*); 6-3 (*kitmu*); 3-5 (*titur išartu*); 7-4 (*pītu*); 4-6 (*serdû*)

22 Kilmer, Anne Draffkorn, Two New Lists of Key Numbers for Mathematical Operations, *Orientalia* 29 (1960), pp. 264-265 with Pl. LXXXIII.

While a first observation shows that the numbers are listed in pairs and do not exceed seven, it would be presumptuous to derive from it, as Kilmer did, that they indubitably represented an ascending heptatonic system and that the paired numbers expressed dyads, meaning that they were played together, or simultaneously. Another scholar, Mme Duchesne Guillemin went as far as giving numbers an equivalence to our Western notational system, without any evidence for her reasons. However, Duchesne-Guillemin did not agree with Kilmer's interpretation of dyads, on arguments of logic, but this was not to slow down Kilmer's insistence at bending the facts to suit her views.

Firstly, in order for a set of numbers to express heptatonism, there must be a system explaining its construction as heptatonism is the consequence of one or more constructions systems. The paired numbers do not suggest any rational construction system and reveal that the sequence of paired numbers, as it is written on this tablet, is the reduction of a larger system into a heptatonic framework, or for a heptachordal instrument. This is made clear from the graph of the paired numbers as they are written on the tablet, as shown below where the sequence is irregular:



15. Graphic representation of the twinned numbers as they are given on heptatonic CBS 10996

if the sequence above were expanded to what I would call its natural status, where the second occurrence of number 1 would be 8, the second occurrence of 2 would be 9; 3 would be 10; 4 would be 11; 5 would be 12; 6 would be 13, and rendered in the graph below:

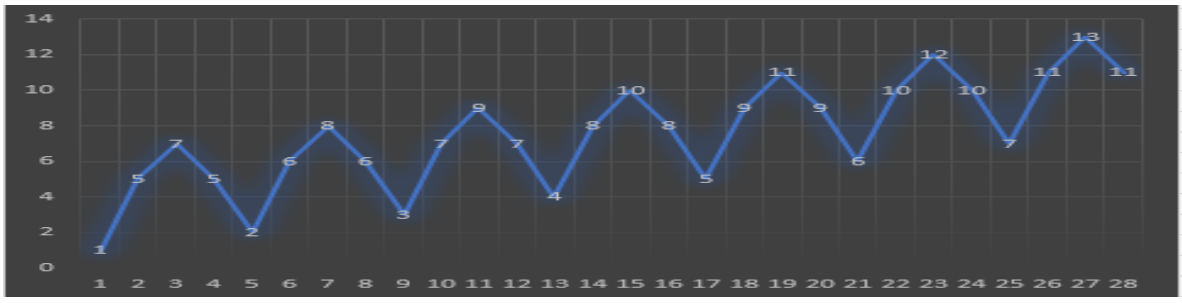


Figure 16. Graphic representation of the hypothetical hyper-systemic tridecatonic forerunner of CBS 10996

The regularity of the graph in figure 16 makes no doubt that the original sequence prior to being 'adapted' to a heptachord, or to a heptatonic system, it was spread on 13 degrees as a hyper-mode or a hyper-system as was known from other occurrences in the history of musicology.

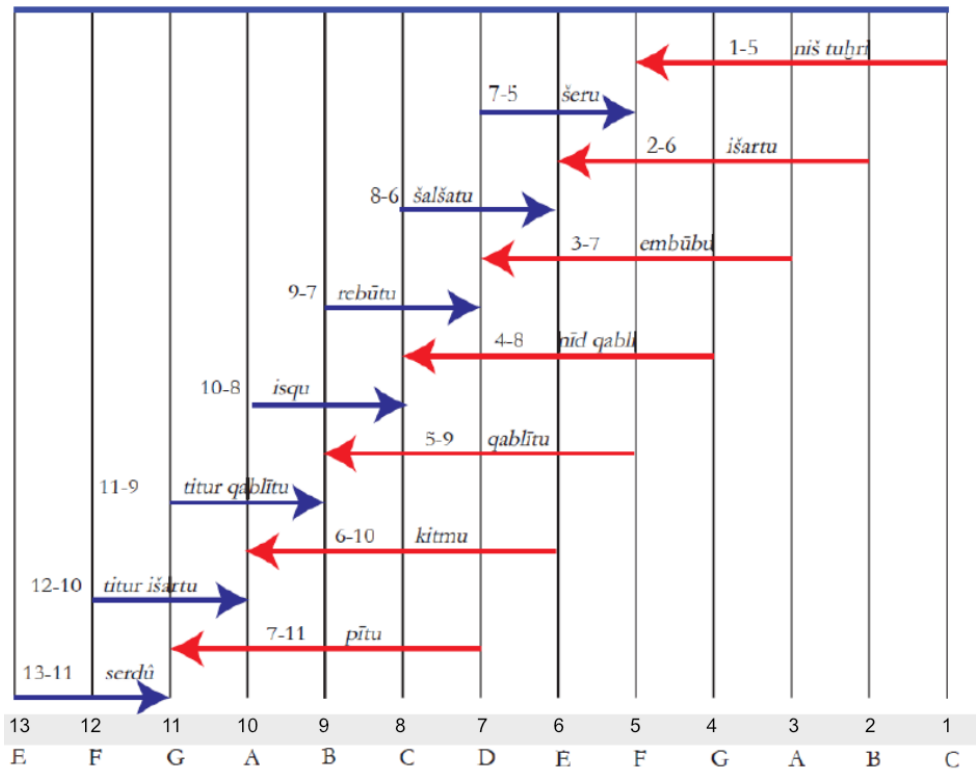


Figure 17. schematisation of the series of intervals and their names as reconstructed from text CBS 10996.

The regularity of the above diagram is evidence of a tridecatonic hyper-system based on a series of consecutive oligotony of conjoined thirds (or intervals of the second) concatenated into hemiolic fifths which in turn aggregate into an enneatonic and then into a tridecatonic hyper-system.

As seen in figure 17, the paired numbers are of two kinds: fifths and thirds. There is no clear indication to provide which was rising or falling. However, since Middle-Eastern systems are mostly descending, we would assume that fifths were descending and thirds ascending. Another Old-Babylonian text dating from around 1800 BC confirms that the system was descending although it could be construed that nothing can really be ascertained on the basis of one text only. What is fundamentally important is that we have, in the original sequence in CBS 10996, a series of fifths, consisting of two conjoined thirds and a list of thirds, consistent with similar oligotonal and hemiolic series. The numbers for each interval in this list locates their positions within the hyper-system and the names defining their content as there would not be any purpose for their names.

Therefore, Kilmer's dyadic theory is severely weakened in the light of my argumentation. Furthermore, does Kilmer mean that it would be 'illegal' to have additionally, consecutive intervals? Thus we may conclude that for an unspecified period of time, a hyper-system of thirteen degrees existed in the Ancient Near East and that from the middle of the first millennium, a reduction to a heptachord/heptatone existed, perhaps along with other systems. There is another text, CBS 1766, also dating from the middle of the first millennium BC, which without any possible doubt proves the existence of heptatonism as not only does it give the construction method but also a set of seven pitch sets or modes as some would call them.

Thus, we can ascertain that the inclusion, rather than the adoption of heptatonism in Middle-Eastern music theory came from an earlier tridecatonic hyper-system based on oligotonal chains of thirds and their concatenation into hemiolic fifths which in turn aggregated in to a tridecatonic hyper-system.

Evidence: *nabnītu xxxii* (**uktin [uk].tin / SIG$_7$ ALAN** (U.3011, field number)

This text is the longer-lasting description of Ancient Sumero-Babylonian music theory. There are precursor copies of this manuscript dating to the Old-Babylonian Period and the Sumerian parts of it suggest an even older origin. This text which is descriptive but can be construed as descriptive because of the way in which the texts is composed.

The text explains the different phases of the development of theory during a period of about 3000 years, their slow metamorphosis from pentatonism to enneatonism and to heptatonism. It is therefore the most important text of theory ever discovered.

Figure 18, Gurney's copy of U.3011 = UET VII, 126 = *nabnītu xxxii* Only columns 1 and 2 are relevant. The tablet appears in *Ur Excavations Texts. Publications of the joint expedition of the British Museum and of the University Museum of the University of Pennsylvania, Philadelphia, to Mesopotamia*. Volume VII, *Middle Babylonian Legal Documents and other Texts*. Oliver R. Gurney. Note the lacuna in L.4 Col.2 which was later corrected in *IRAQ* XLVI 82, note 1. Professor Gurney writes back to me on this matter on the 15th April 1996: ...I must have left the end of the line for a second look because it was dirty or otherwise difficult to read and then forgotten to come back to it. This happened to me several times!

Sir Leonard Woolley (1880-1960) found a fragmentary copy of the tablet at Ur in Southern Mesopotamia, south of the main courtyard of the *Dublamaḫ* temple, in the late twenties. This tablet is Neo-Babylonian, about 800/600 BC. However, the knowledge it includes is certainly much older as it describes, possibly, the stringing of an archetypal lyre fitted with nine strings. Although most copies of this lexical series are relatively late, around the middle of the first millennium BC, there is an Old-Babylonian precursor known as the '*Proto-nabnītu*' published in *UET* VI, 358, and also Middle-Babylonian versions dated around 1000 BC, including one damaged copy.

The table below gives three interpretations, a), b) and c). a) is Finkel's interpretation of U.3011 (field number), being Woolley's find. b) extracts the five Sumerian names of strings at the beginning of the first five lines of the obverse of BM 65217+66616. c) is Krispijn's interpretation which shows slight differences with Finkel's.

Although the oldest version of this text is not earlier than Old-Babylonian, its structure, which is descriptive, suggests a much older source which I would place at the dawn of literacy if not earlier, propagated in oral transmission as this text has an undeniable, pre-literate visual origin. I will explain this audacious hypothesis in due time.

This text is the thirty-second tablet of the series *nabnītu*. Copies would have been distributed widely, during a number of centuries, possibly even millennia in the various provinces and kingdoms of the Occidental Orient as it certainly was a type of encyclopædia essential to scholarly institutions, temples and palaces.

Some essential philological remarks about U.3011 are essential before discussing the musicological significance of this bilingual, text:

1) In a) and c), the Akkadian is partly but not entirely a literal translation of the Sumerian.

2) We assume that the Sumerian entries are descriptive and are the names and locations of each of the nine strings.

3) There appears be a tonal interrelationship between lines 1 and 5 in a).

4) Lines 9 to 5 seem to stand in symmetry with lines 5 to 1.

5) We take *qud-mu-um*, in line 1, as the adjective *qudmû*, meaning 'front', following the explicit writing *qud-mu-ú* in CBS 10996, rather that the noun *qudmu*, 'front'.

6) Similarly, we take *šá-mu-šu-um* to stand for the adjective *šamušû*, 'adjacent', understanding Sumerian **sa-uš** as **sa-ús**, the underlying Akkadian verb being *emēdu*. *šá-mu-šu-um*, is reconstructed as **sa-uš>sawuš** with /**w**/ as a glide. The /**w**/ is written with phonograms containing /m/ from the Old-Babylonian Period onwards (Von Soden 1995, GAG §21d).

7) We take *úḫ-ru-um* in line 9 as the adjective *uḫrû*, rather than the noun *uḫru*, 'rear' as found in lines 6 to 8.

lines		Sumerian	Translation	Akkadian	Translation
l.1	a)	**sa.di**	string DI	*qud-mu-⌜um⌝*	prime? string
	b)	**di.iš.šú**	first	*qud-mu-ú*	first
	c)	**sa.sá (=DI)**	'rival' string	*qud-mu-⌜um⌝*	front? string
l.2	a)	**sa.úš**	adjacent string	*šá-mu-šu-um*	adjacent (string)
	b)	**me.in**	second	*šá-mu-ši*	second
	c)	**sa.úš**	next string	*šá-mu-šu-um*	next string (loan word from Sumerian **sa-úš**
l.3	a)	**sa.3.sa.sig**	string 3 string thin	*šá-al-šu qa-a⌜t-nu⌝*	third (string) thin
	b)	**e.šà**	third	*šal-šú qa-at-nu*	third (string) thin
	c)	**sa.3.sa.sig**		*šá-al-šu qa-at-nu*	third (string) thin
l.4	a)	**sa.4.tur**	string 4 small	A-[DU]	Ea-*banû* Ea-the creator
	b)	**lam.ma**	fourth	*a-ba-nu*	Ea-*banû* Ea-the creator
	c)	**sa.4.tur**	string 4 small	*<d[e]>-a*.[**dú**]	Ea-the creator
l.5	a)	**sa.di.*5**	string **DI** 5	*ḫa-am-[šu]*	fifth (string)
	b)	**i̯a**	fifth	*ḫa-an-šu*	fifth
	c)	**sa.sá (=DI).5!**	fifth 'rival' string	*ḫa-am-[šu]*	fifth (string)
l.6	a)	**sa.4.a.ga.gul**	string 4 rear	*ri-bi úḫ-ri-[im]*	fourth of the rear (string)
	b)		fourth string of the bigger back		
	c)	**sa.4.a.ga.gul**		*ri-bi úḫ-ri-[im]*	fourth of the back (string)
l.7	a)	**sa.3.a.ga.gul**	string 3 rear	*šal-ši úḫ-ri-im*	third of the rear (string)
	b)			*šal-ši úḫ-ri-im*	
	c)	**sa.3.a.ga.gul**	third string of the bigger back		third of the back (string)
l.8	a)	**⌜sa.2.a.ga⌝.gul**	string 2 rear	*ši-ni úḫ-ri-im*	second of the rear (string)
	b)				
	c)	**⌜sa.2.a.ga⌝.gul**	second string of the bigger back	*ši-ni úḫ-ri-im*	second of the back (string)
l.9	a)	**[sa.1].⌜a⌝.ga.gul.la**	string 1 rear		rear (string)
	b)				
	c)	**[sa.1].⌜a⌝.ga.gul.la**	first string of the bigger back	*úḫ-ru-um*	back (string)
l.10	a)	**9 ⌜sa⌝.a**	9 strings		9 strings
	b)				
	c)	**9 ⌜sa⌝.a!**	They are 9 strings	9 *pi-it-nu*	9 strings

Figure 19. a) Finkel's interpretation from U.3011; b) Kilmer's interpretation from BM 65217+66616, first five lines. c) Krispijn's interpretation of U.3011.

The first question that strikes the reader of this text is why the first two strings in Sumerian and Akkadian are not simply called 'string 1' and 'string 2,' what is the meaning of 'small', 'thin' and 'Ea-the creator', and why the first line has **sa.di** without '1' while the fifth line has **sa.di** with, we think '5', although Professor Gurney saw '4'. What is the meaning of **sa.di**? These writings cannot encapsulate some extraordinary or unintelligible system of pitches but can be explained musicologically. As we will see, the third and fourth strings give a clear indication of the transition from hyper-systemic anhemitonism to hemitonism. What is more, the hyper-systemic enneatonic system enshrined in *Nabnītu xxxii* reappears in later arrangement of pitch subsets.

Structuralism

According to Claude Lévi-Strauss, cultures are viewed as systems which are analysed in terms of the structural relations among their elements. Thus patterns in cultural systems of which musical systems are part, are products of the structure of the human mind.

The original layout of the earliest theoretical system came from the yoke of the monumental lyre. It is a linear structure, a straight and slender wooden stick, on which strings are tuned by means of levers to satisfy the cultural sphere with which they identify.

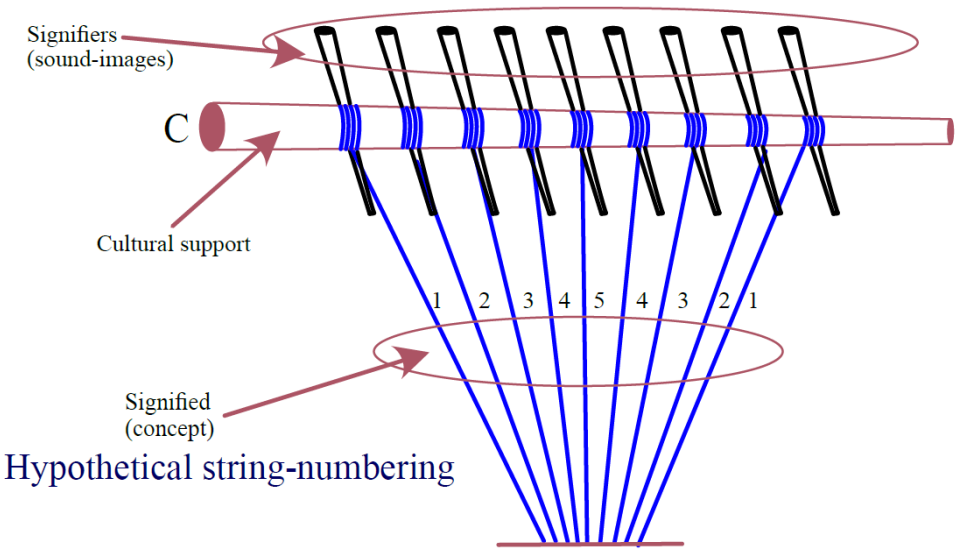


Figure 20. The construction of the lyres described in text *nabnītu xxxii* in terms of a cognitive process.

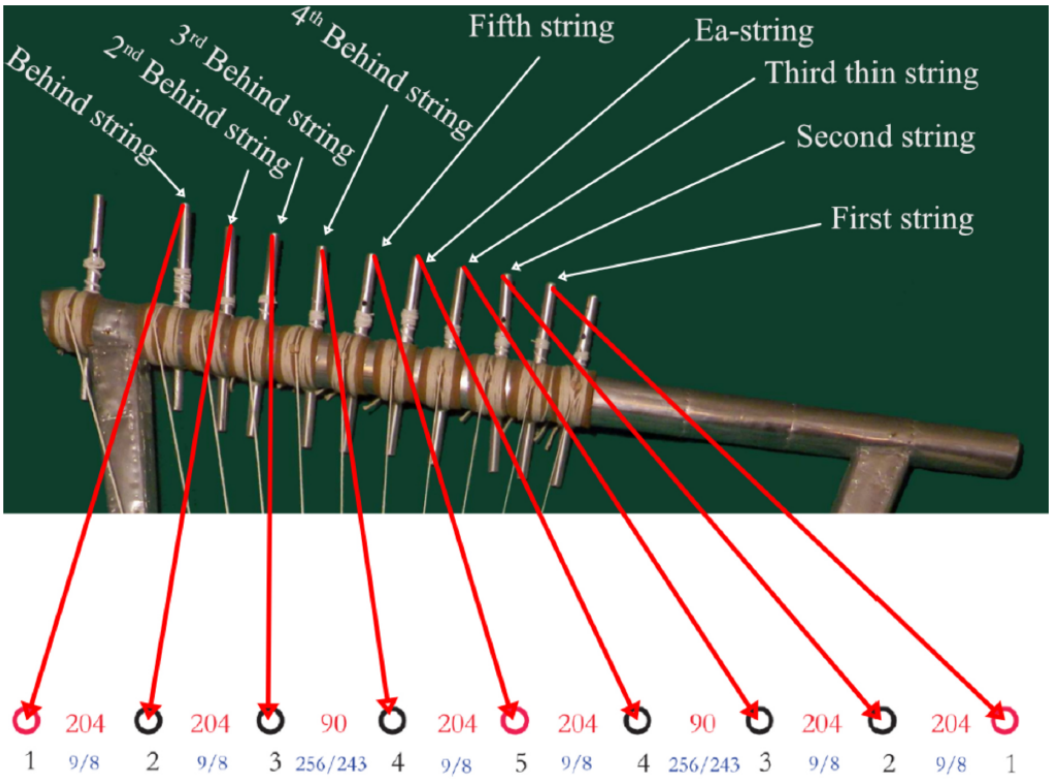


Figure 21. Cognitive image process of text *nabnītu xxxii*.

This led me to the hypothesis that the descriptive enneachordal listing of the strings of the lyre in the text were also hiding the tuning method leading to the structure of the hyper-systemic enneatonic pitch set which I will now will describe as illustrated in figure 22:

1) String 5, being the center of the system would have been tuned to a hypothetical standard pitch, or more likely, to a tension satisfying the lyricist.

2) From this central pitch, string 1 of the treble would be tuned up as a (just) fifth.

3) from the same central pitch, string 1 of the bass would be tuned down to a (just) fifth.

4) from both first strings (treble and bass) the fourth strings (treble and bass) would be tuned up and down by a (just fourth).

5) from the central; string 5, two (just) fourths would be projected to the treble and to the bass, generating a hyper-systemic anhemitonic pentatone: G-A-C-D-E-G-A, as shown in the figure below:

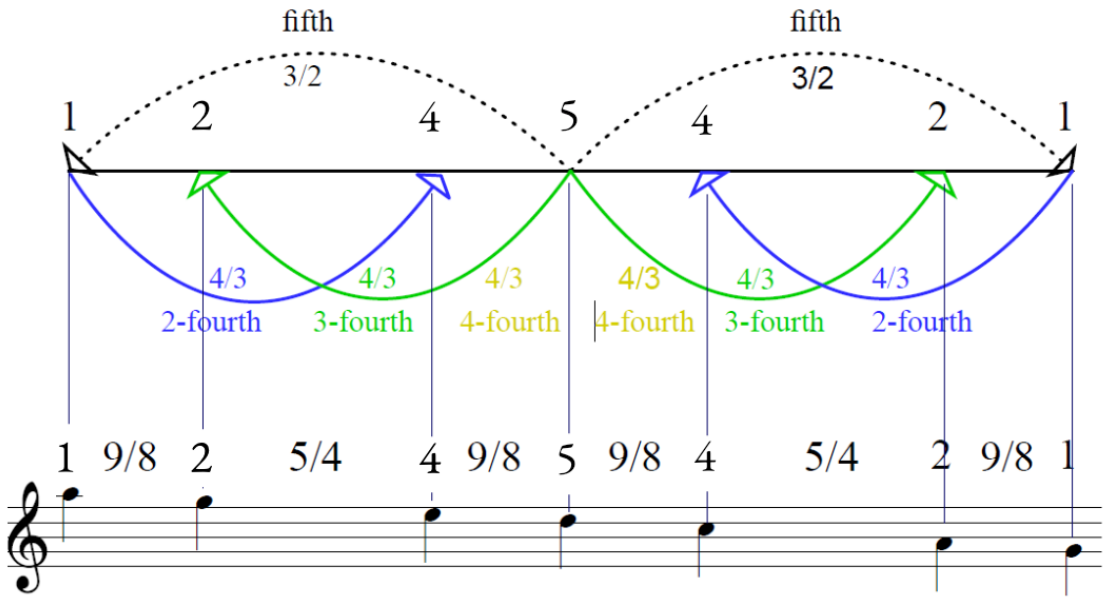


Figure 22. Graphic representation of the hyper-systemic anhemitonic pentatonic construction.

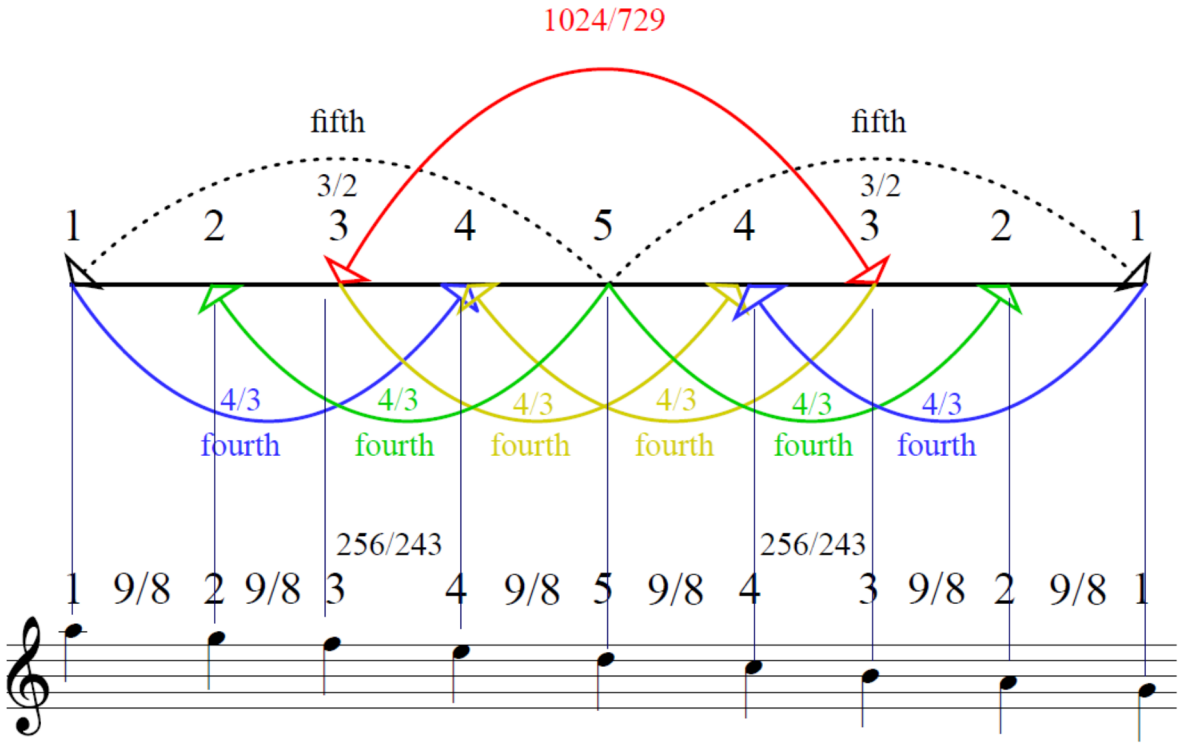


Figure 23. Graphic representation of the hyper-systemic hemitonic enneatonic construction.

The stave below represents Dom Jean Claire's third archaic intonation. It is ascending, presumably. However it is palindromic as is the Babylonian model, therefore with identical intervals between pitches. The *piena* are mobile B and F as they stand in the Babylonian model when they were added when the system shifted from anhemitonic to hemitonic.

Figure 24. Dom Jean Claire's archaic intonations with encircled *piena* at B and F.

Thus, monodic incantations such as Psalm *Immense cæli*, in figure 9 and the hymn *Sursum corda* in figure 10 were composed from the Babylonian model as the consequence of cognitive processes.

Conclusions

It will become evident from these pages that for millennia of practice, non-octaval non-numeric, monodic, oligotonic, hemiolic, hyper-systems and hypermodes, all built from chains of conjoined thirds, filled or empty, have been the most common systems, if such a word is suitable for a practice borne from cognitive processes, and which are still in usage for music round the world. As a composer, I would add that when I 'conceptualise' music, as I do not like using the verb 'to write', as music is written for reasons of convention which have nothing to do with the compositional process, but for sure I never think of a tonality or of a modality, of a form or of another. When I improvise, I forget all I know about theory. I simply leave my mind play with sounds without any constraints of numbers, of regulations, of rules and certainly not of obedience to the octave and its numbers which for me are all but musical. Sorry Pythagoras, try harder! Neither octave, nor numbers were needed to achieve probably the largest repertoire of monodies the world ever heard, and still going strong. For sure, heptatonism emerged in the middle of the first millennium BC when musicians applied numbers to pitches, and turned from horizontality to verticality with the advent of heterophonies, polyphonies and eventually harmony at the turn of the first millennium AD, when another world fundamentally different, opened its doors to other geniuses with Bach as ruling god. Thus, two forms of music live side by side, none better than the other but both amazing.